

Bark and Ambrosia Beetle Early Detection For the State of New Jersey

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Non-native bark and ambrosia beetles are a serious threat to our nation's urban and rural forests. Asian ambrosia beetle has been reported in many nurseries in New Jersey. We participated the national Early Detection and Rapid Response (EDRR) during 2008-2010 and continued survey in 2011. The goal of this survey is to detect, delimit and monitor newly introduced exotic bark and ambrosia beetles, Scolytinae, Curculionidae, Coleoptera, at selected high-risk forest areas in order to quickly assess and respond to newly detected infestations.

Material and Methods

Trap Site Selection. Nine sites are used for the survey in the State of New Jersey in 2008 and 2009, 12 sites in 2010, and 16 sites in 2011 (Table 1). These sites represented typical nursery, woods, or natural reservation settings. The survey traps were placed in wooded areas near these sites.

Table 1. Survey sites in New Jersey

Year	County	Town	Site Name	Latitude (N)	Longitude (W)	Site Type
2008	Hunterdon	Franklin	Snyder Farm	40.5618	74.9624	Mixed
	Mercer	Millstone	Karkalitz Nursery	40.2310	74.5067	Nursery
	Middlesex	North Brunswick	Rutgers Gardern	40.4727	74.4251	Mixed
	Monmouth	Manalapan	Halka Nursery	40.2270	74.3690	Nursery
			Cream Ridge Farm	40.1128	74.5246	Hardwoods
			Princeton Nursery	40.1238	74.5691	Nursery
				40.1345	74.5691	Nursery
	Somerset	Hillsborough	Duke Farms	40.5449	74.6377	Hardwoods
2009	Sussex	Newton	Newton	41.1248	74.7482	Nursery
	Cumberland	Bridgeton	Bridgeton	39.4505	75.1210	Mixed
	Hunterdon	Franklin	Snyder Farm	40.5618	74.9624	Mixed
	Mercer	Millstone	Karkalitz Nursery	40.2310	74.5070	Nursery
	Middlesex	North Brunswick	Rutgers Gardern	40.4727	74.4251	Mixed
	Monmouth	Manalapan	Halka Nursery	40.2270	74.3690	Nursery
			Cream Ridge Farm	40.1130	74.5250	Hardwoods
			Princeton Nursery	40.1340	74.5691	Nursery
2010	Cumberland	Somerset	Hillsborough	40.5449	74.6377	Hardwoods
		Sussex	Newton	41.1248	74.7482	Nursery
	Cumberland	Deerfeild	Rosenhayn	39.4501	75.1211	Mixed
		Upper Deerfeild	Upper Deerfeild	39.4420	75.1756	Mixed

	Hunterdon	Franklin	Snyder Farm	40.5618	74.9624	Mixed
	Mercer	Millstone	Karkalitz Nursery	40.2310	74.5067	Nursery
	Middlesex	North Brunswick	Rutgers Gardern	40.4721	74.4250	Mixed
		South Brunswick	Davidson Mill Park	40.4121	74.4995	Mixed
	Monmouth	Manalapan	Halka Nursery	40.2270	74.3689	Nursery
		Upper Freehold	Cream Ridge Farm	40.1128	74.5246	Hardwoods
	Somerset	Hillsborough	Duke Farms	40.5449	74.6377	Hardwoods
		Montgomery	Yorkshirewoods	40.3910	74.6689	Hardwoods
	Sussex	Frankford	Frankford	41.1254	74.7550	Hardwoods
		Newton	Newton	41.1248	74.7482	Nursery
2011	Cumberland	Bridgeton	Bridgeton	39.4502	75.1218	Mixed
				39.4511	75.1225	Mixed
	Monmouth	Manalapan	Halka Nursery	40.2260	74.3706	Nursery
				40.2261	74.3675	Nursery
				40.2263	74.3689	Nursery
				40.2288	74.3711	Nursery
				40.2291	74.3689	Nursery
				40.2301	74.3667	Nursery
	Somerset	Hillsborough	Duke Farms	40.5461	74.6383	Hardwoods
				40.5462	74.6395	Hardwoods
				40.5465	74.6371	Hardwoods
				40.5484	74.6360	Hardwoods
				40.5496	74.6360	Hardwoods
				40.5508	74.6364	Hardwoods
	Sussex	Newton	Newton	41.1244	74.7546	Nursery
				41.1252	74.7553	Nursery

Number and Types of Traps and Lures. At each of the survey sites, three 12-unit Lindgren funnel traps (Synergy Semiochemicals Corp., Burnaby, BC, V5J 5G3, Canada) at least 25 m. apart were set up by the time of first beetle flight, i.e. in April, about the time of bud break. The trapping period lasts for 20 weeks from April through July. These traps and lures (Synergy Semiochemicals Corp.): (1) Ultra-high release (UHR) ethanol lure only, which is general attractant for wood boring insects in deciduous hosts. (2) UHR alpha-pinene (blue pouch) and UHR ethanol (black pouch) lures together, which are general attractants for wood boring insects in coniferous hosts. (3) Three-component exotic *Ips* lure (2 bubble caps, one pouch). More specific for conifer-feeding exotic bark beetles e.g. *Ips typographus*, *Ips sexdentatus*, *Hylurgus ligniperda* and *Orthotomicus erosus*.

Attach lures to the connecting supports so they hang on the outside of the trap at the middle of the funnel column. Attach the top of the UHR ethanol and alpha-pinene lures so that the middle of the lure is at the middle of the funnel column. Tuck the lower portion of the pouch into a lower funnel to provide support and prevent it from swinging freely. Attach *Ips* lures so all three components hang on the outside of the middle funnel at the same height. Fill the collecting cup approximately 1/3 full with preservative antifreeze after attaching it to the trap. Traps were checked every two weeks for the 20 week trapping period.

Once a trap sample is collected and brought back to the Department of Entomology, Rutgers University for sorting and identification. Specimen identification was performed by following the bark beetle identification training materials provided by National EDRR program. The final identifications were confirmed or performed by Department of Entomology, Cornell University.

Results and Discussions

Common species for all four years:

Twenty-two common bark beetle species collected in every collection year during 2008-2011 and composed 89.80% of the 38143 beetle collection. The most dominant species is Asian ambrosia beetle, *Xylosandrus crassiusculus*, 35.95% of the total collection. The sister species *Xylosandrus germanus* is 10.81% of the collection (Table 2).

Table 2. Common species collected in New Jersey (2008-2011)

Species	2008	2009	2010	2011	Total	Percentage
<i>Xylosandrus crassiusculus</i>	3706	137	3296	6574	13713	35.95%
<i>Xyleborinus saxesenii</i>	2994	130	942	2622	6688	17.53%
<i>Xylosandrus germanus</i>	773	116	1118	2117	4124	10.81%
<i>Euwallacea validus</i>	84	34	249	1619	1986	5.21%
<i>Hylastes porculus</i>	40	5	7	1425	1477	3.87%
<i>Pityophthorus</i>	64	32	27	1173	1296	3.40%
<i>Hypothenemus</i>	682	56	279	107	1124	2.95%
<i>Xyleborus californicus</i>	124	55	209	527	915	2.40%
<i>Ips grandicollis</i>	172	28	39	263	502	1.32%
<i>Hylastes opacus</i>	43	7	10	372	432	1.13%
<i>Gnathotrichus materiarius</i>	80	19	45	287	431	1.13%
<i>Monarthrum mali</i>	95	37	56	156	344	0.90%
<i>Orthotomicus caelatus</i>	40	16	16	236	308	0.81%
<i>Dendroctonus valens</i>	19	9	50	222	300	0.79%
<i>Monarthrum fasciatum</i>	106	26	20	60	212	0.56%
<i>Xyloterinus politus</i>	65	15	16	38	134	0.35%
<i>Dendroctonus terebrans</i>	26	7	17	56	106	0.28%
<i>Xyleborinus alni</i>	25	2	1	53	81	0.21%
<i>Ips pini</i>	21	2	1	5	29	0.08%
<i>Pityogenes hopkinsi</i>	3	2	2	19	26	0.07%
<i>Corthylus punctatissimus</i>	1	12	4	1	18	0.05%

Hylastes tenuis	1	4	2	1	8	0.02%
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Species collected only in 2008-2010:

Twenty species were collected only in the first three years. They were 7.36% of the total collection (Table 3).

Table 3. Bark beetle species collected during 2008-2010 in New Jersey.

Species	2008	2009	2010	Total	Percentage
Dryocoetes autographus	482	43	675	1200	3.15%
Ambrosiophilus atratus	476	60	387	923	2.42%
Anisandrus sayi	12	7	118	137	0.36%
Phloeotribus liminaris	62	16	43	121	0.32%
Ambrosiodmus obliquus	22	12	39	73	0.19%
Corthylus columbianus	16	9	35	60	0.16%
Dryoxylon onoharaensum	26	9	18	53	0.14%
Lymantor decipiens	38	2	13	53	0.14%
Xyleborus pelliculosus	16	13	9	38	0.10%
Hylesinus aculeatus	21	5	4	30	0.08%
Xyleborus ferrugineus	4	6	14	24	0.06%
Xyleborus pubescens	10	2	8	20	0.05%
Ambrosiodmus rubricollis	4	3	9	16	0.04%
Pseudopityophthorus	4	4	7	15	0.04%
Xyleborus celsus	5	5	3	13	0.03%
Hylocurus rudis	5	3	2	10	0.03%
Xyleborus xylographus	4	2	2	8	0.02%
Dryocoetes affaber	1	2	4	7	0.02%
Anisandrus dispar	1	2	1	4	0.01%
Scolytus rugulosus	2	1	1	4	0.01%

Rare species:

Twenty-eight bark beetle species were collected at a very low level or only collected in only one or two years. They are 2.83% of the total collection (Table 4).

Table 4. Rare bark beetle species collected during 2008-2011 in New Jersey.

Species	2008	2009	2010	2011	Total	Percentage
Xyleborus atratus	0	0	0	770	770	2.02%
Cryphalus	0	0	0	86	86	0.23%
Trypodendron lineatum	0	0	0	79	79	0.21%
Hylastes salebrosus	0	0	0	44	44	0.12%
Scolytus multistriatus	2	0	0	22	24	0.06%

Ambrosiodmus tachygraphus	20	3	0	0	23	0.06%
Hylurgops rugipennis pinifex	5	0	0	3	8	0.02%
Cnesinus strigicollis	4	0	3	0	7	0.02%
Ips calligraphus	0	1	1	5	7	0.02%
Xyleborus affinis	0	2	1	2	5	0.01%
Xyleborus pfeili	0	4	1	0	5	0.01%
Ips avulsus	0	0	0	4	4	0.01%
Scolytus scolytus	0	0	0	3	3	0.01%
Crypturgus	1	1	0	0	2	0.01%
Pityogenes bidenatus	0	0	0	2	2	0.01%
Conophthorus coniperda	1	0	0	0	1	0.00%
Dendroctonus frontalis	0	0	0	1	1	0.00%
Dryocoetes caryi	0	1	0	0	1	0.00%
Hylurgopinus rufipes	1	0	0	0	1	0.00%
Micracis	0	0	1	0	1	0.00%
Phloeosinus	0	1	0	0	1	0.00%
Scolytus mali	0	1	0	0	1	0.00%
Scolytus schevyrewi	0	0	1	0	1	0.00%
Thysanoes fimbricornis	0	0	1	0	1	0.00%
Tomicus piniperda	1	0	0	0	1	0.00%
Xyleborinus gracilis	0	0	1	0	1	0.00%
Xyleborus impressus	1	0	0	0	1	0.00%

Species attracted to all three type lures.

Forty-one bark beetle species were collected by all three trap lures. *Xylosandrus crassiusculus*, *Xyleborinus saxesenii*, *Hypothenemus*, *Xyleborus californicus*, *Xyleborus atratus*, *Anisandrus sayi*, *Xyloterinus politus*, and *Phloeotribus liminaris* significantly prefer Ethanol lure traps. *Pityophthorus*, *Dryocoetes autographus*, *Ips grandicollis*, *Gnathotrichus materiarius*, *Dendroctonus valens*, and *Dendroctonus terebrans* significantly prefer Pinene & Ethanol lure traps. *Dendroctonus terebrans* significantly prefer IPS lured traps (Table 5).

Table 5. Species collected from all lures

Species	Ethanol	IPS	Pinene & Ethanol
<i>Xylosandrus crassiusculus</i>	7485	1266	4962
<i>Xyleborinus saxesenii</i>	4640	457	1591
<i>Xylosandrus germanus</i>	1853	384	1887
<i>Euwallacea validus</i>	971	729	286
<i>Hylastes porculus</i>	600	396	481

Pityophthorus	98	42	1156
Dryocoetes autographus	10	27	1163
Hypothenemus	640	262	222
Ambrosiophilus atratus	368	301	254
Xyleborus californicus	718	75	122
Xyleborus atratus	411	144	215
Ips grandicollis	12	22	468
Hylastes opacus	122	142	168
Gnathotrichus materiarius	24	40	367
Monarthrum mali	167	26	151
Orthotomicus caelatus	48	156	104
Dendroctonus valens	1	4	295
Monarthrum fasciatum	95	21	96
Anisandrus sayi	102	19	16
Xyloterinus politus	104	19	11
Phloeotribus liminaris	100	10	11
Dendroctonus terebrans	1	2	103
Xyleborinus alni	57	10	14
Trypodendron lineatum	37	8	34
Ambrosiodmus obliquus	52	10	11
Corthylus columbianus	32	2	26
Dryoxylon onoharaensum	43	2	8
Hylastes salebrosus	13	11	20
Xyleborus pelliculosus	34	2	2
Hylesinus aculeatus	8	9	13
Pityogenes hopkinsi	6	12	8
Scolytus multistriatus	4	1	19
Xyleborus ferrugineus	9	4	11
Ambrosiodmus tachygraphus	18	2	3
Xyleborus pubescens	2	1	17
Corthylus punctatissimus	10	4	4
Ambrosiodmus rubricollis	4	1	11
Pseudopityophthorus	8	4	3
Xyleborus xylographus	5	1	2
Xyleborus affinis	1	2	2
Scolytus rugulosus	2	1	1

Fifteen species were collected by only type lure traps. Twelve species were collected by two lure types. However, the numbers of beetles per species are too low to draw a conclusion on the preference (Table 6).

Table 6. Species attracted to only one or two lure types

Species	Ethanol	IPS	Pinene & Ethanol
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Cnesinus strigicollis	6	0	1
Anisandrus dispar	4	0	0
Conophthorus coniperda	0	0	1
Cryphalus	21	0	65
Lymantria decipiens	1	52	0
Ips pini	0	17	12
Xyleborus celsus	11	2	0
Hylocurus rudis	7	3	0
Hylastes tenuis	2	0	6
Hylurgops rugipennis pinifex	0	1	7
Dryocoetes affaber	0	0	7
Ips calligraphus	0	4	3
Xyleborus pfeili	5	0	0
Ips avulsus	0	3	1
Scolytus scolytus	3	0	0
Crypturgus	0	1	1
Pityogenes bidenatus	2	0	0
Dendroctonus frontalis	0	0	1
Dryocoetes caryi	0	0	1
Hylurgopinus rufipes	0	0	1
Micracis	1	0	0
Phloeosinus	1	0	0
Scolytus mali	1	0	0
Scolytus schevyrewi	0	0	1
Thysanoes fimbricornis	1	0	0
Tomicus piniperda	0	0	1
Xyleborinus gracilis	1	0	0
Xyleborus impressus	1	0	0

Species distribution for surveyed counties

Sixteen species were collected in all seven counties survey (Table 7): *Ambrosiophilus atratus*, *Dendroctonus valens*, *Euwallacea validus*, *Gnathotrichus materiarius*, *Hylastes opacus*, *Hypothenemus*, *Ips grandicollis*, *Monarthrum fasciatum*, *Monarthrum mali*, *Monarthrum mali*, *Orthotomicus caelatus*, *Phloeotribus liminaris*, *Pityophthorus*, *Xyleborinus alni*, *Xyleborinus saxesenii*, *Xyleborus californicus*, *Xylosandrus crassiusculus*, and *Xylosandrus germanus*. This indicates that almost all major species present the entire region in New Jersey we surveyed.

Table 7. Species distribution among the counties surveyed.

Species	Cumberland	Hunterdon	Mercer	Middlesex	Monmouth	Somerset	Sussex
Ambrosiodmus obliquus	8	0	0	35	29	1	0
Ambrosiodmus rubricollis	0	2	0	6	4	4	0
Ambrosiodmus tachygraphus	0	0	0	0	19	4	0
Ambrosiophilus atratus	18	36	66	215	301	202	85

Anisandrus dispar	0	0	0	0	3	1	0
Anisandrus sayi	27	3	0	17	7	25	58
Cnesinus strigicollis	0	1	2	2	2	0	0
Conophthorus coniperda	0	0	0	0	1	0	0
Corthylus columbianus	12	0	0	7	19	20	2
Corthylus punctatissimus	6	0	1	4	5	1	1
Cryphalus	1	0	0	0	0	85	0
Crypturgus	0	0	0	0	0	2	0
Dendroctonus frontalis	0	0	0	0	1	0	0
Dendroctonus terebrans	6	0	9	4	78	4	5
Dendroctonus valens	5	2	9	10	86	181	7
Dryocoetes affaber	0	0	0	1	0	2	4
Dryocoetes autographus	0	38	2	22	49	717	372
Dryocoetes caryi	0	1	0	0	0	0	0
Dryoxylon onoharaensum	13	4	7	3	20	6	0
Euwallacea validus	3	2	1	127	1152	682	19
Gnathotrichus materiarius	8	10	2	10	238	141	22
Hylastes opacus	26	3	5	4	89	294	11
Hylastes porculus	80	0	0	6	212	859	320
Hylastes salebrosus	2	0	0	0	0	39	3
Hylastes tenuis	7	0	0	0	0	1	0
Hylesinus aculeatus	0	3	0	0	24	1	2
Hylocurus rudis	0	1	0	1	6	1	1
Hylurgopinus rufipes	0	0	0	0	0	0	1
Hylurgops rugipennis pinifex	3	0	0	0	5	0	0
Hypothenemus	50	101	81	189	360	310	33
Ips avulsus	0	0	0	0	0	3	0
Ips avulsus	0	0	0	0	0	1	0
Ips calligraphus	1	0	1	0	4	1	0
Ips grandicollis	6	36	114	8	200	129	9
Ips pini	0	4	0	1	16	6	2
Lymantria decipiens	0	8	7	4	5	15	14
Micracis	0	0	0	0	0	0	1
Monarthrum fasciatum	6	10	8	31	101	48	8
Monarthrum mali	18	12	6	32	154	105	17
Orthotomicus caelatus	2	2	7	7	41	240	9
Phloeosinus	0	0	1	0	0	0	0
Phloeotribus liminaris	42	4	4	14	48	2	7
Pityogenes bidenatus	0	0	0	0	2	0	0
Pityogenes hopkinsi	1	0	0	1	7	16	1
Pityophthorus	8	9	5	14	289	784	186
Pityophthorus spp	0	0	0	0	1	0	0
Pseudopityophthorus	0	3	0	6	4	1	1
Scolytus mali	0	0	0	0	1	0	0
Scolytus multistriatus	0	0	0	0	21	3	0
Scolytus rugulosus	0	0	4	0	0	0	0
Scolytus scolytus	0	0	0	0	0	0	3
Scolytus schevyrewi	0	0	0	0	1	0	0

Thysanoes fimbicornis	0	0	0	1	0	0	0
Tomicus piniperda	0	1	0	0	0	0	0
Trypodendron lineatum	3	0	0	0	37	37	2
Xyleborinus alni	7	1	5	6	22	27	13
Xyleborinus gracilis	0	0	0	0	1	0	0
Xyleborinus saxesenii	244	125	155	1511	3294	1072	287
Xyleborus affinis	2	0	0	0	1	2	0
Xyleborus atratus	9	0	0	0	384	304	73
Xyleborus californicus	68	56	5	131	438	186	31
Xyleborus celsus	0	1	0	0	4	6	2
Xyleborus ferrugineus	14	1	1	3	4	1	0
Xyleborus impressus	0	0	0	0	1	0	0
Xyleborus pelliculosus	1	0	1	12	12	5	7
Xyleborus pfeili	0	0	0	2	3	0	0
Xyleborus pubescens	2	0	1	4	11	0	2
Xyleborus xylographus	0	1	2	0	4	0	1
Xylosandrus crassiusculus	1229	381	215	1061	5104	5415	308
Xylosandrus germanus	193	114	57	411	1434	1626	289
Xyloterinus politus	0	1	0	45	45	38	5